

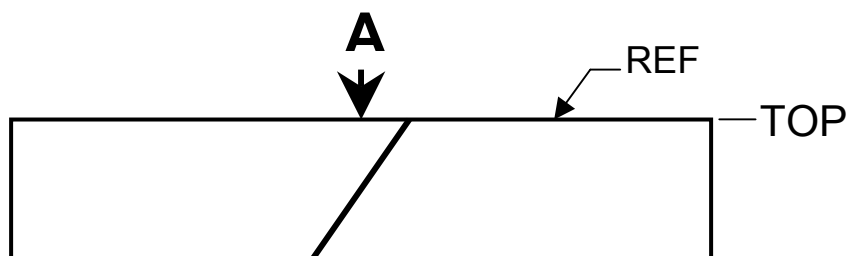
<b>GEARTECH</b>	QUALITY PROCEDURE	No. QP8502	SHEET 1 OF 6	
		Rev. A		
Procedure for Inspection of Gear Tooth Accuracy		BY RLE	DATE	7/09/99
		CKD JRM	DATE	7/09/99
1.	Scope			
1.1	This procedure covers inspection of gear tooth accuracy with gear tooth inspection machines.			
2.	Referenced Documents			
2.1	ANSI/AGMA 2000-A88 Gear Classification and Inspection Handbook.			
2.2	ANSI/AGMA 2010-A94 Measuring Instrument Calibration – Part I, Involute Measurement.			
2.3	ANSI/AGMA 2113-A97 Measuring Instrument Calibration, Gear Tooth Alignment Measurement.			
2.2	ANSI/AGMA ISO 1328-1 Cylindrical Gears- ISO System of Accuracy- Part 1: Definitions and Allowable Values of Deviations Relevant to Corresponding Flanks of Gear Teeth.			
3.	Terminology			
3.1	Definitions- For definitions of terms see ANSI/AGMA 2000-A88 or ANSI/AGMA ISO 1328-1 as appropriate.			
3.2	Definitions of terms specific to this Quality Procedure:			
3.2.1	Active Flank- The flank that is loaded in service.			
3.2.2	Left Hand Helix- A helix that runs in the sense of a left-hand screw thread. Figure 3 shows an internal gear with a left-hand helix.			
3.2.3	Left Flank- Looking in the view direction, the left flank bounds the left side of the tooth, when the tooth is viewed with the tip above the root.			
3.2.4	Right Flank- Looking in the view direction, the right flank bounds the right side of the tooth, when the tooth is viewed with the tip above the root.			
3.2.5	Right Hand Helix- A helix that runs in the sense of a right-hand screw thread. Figure 1 shows an external gear with a right-hand helix.			
3.2.6	Datum Axis- The axis about which the gear rotates during inspection of gear tooth accuracy. The datum axis shall match the functional axis as closely as possible. This is best achieved by using functional mounting surfaces as the datum surfaces.			
3.2.7	Functional Axis- The axis about which the gear rotates in service. It is defined by the centers of the functional mounting surfaces.			
3.2.8	Reference Face- For symmetrical gears, one face shall be identified with a permanent, unique mark or other unique feature.			
3.2.9	Evaluation length- That part of the usable length to which the tolerances of the specified accuracy class shall apply. Unless otherwise specified, the evaluation length for a profile chart shall extend from MAX CHAM to PCD, and the evaluation length for a tooth alignment chart shall extend for the central 90% of the face width.			
3.2.10	MIN CHAM- Position on the profile chart corresponding to the maximum tip radius minus the minimum tip chamfer.			

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3.2.11	MAX CHAM- Position on the profile chart corresponding to the minimum tip radius minus the maximum tip chamfer.			
3.2.12	MOD- Position on the profile chart corresponding to the start of tip or root relief.			
3.2.13	HPSTC- Position on the profile chart corresponding to the highest-point-of-single-tooth-contact.			
3.2.14	LPSTC- Position on the profile chart corresponding to the lowest-point-of-single-tooth-contact.			
3.2.15	SAP- Position on the profile chart corresponding to the start-of-active-profile.			
3.2.16	PCD- Position on the profile chart corresponding to the profile control diameter.			
4.	Significance and Use- Unless otherwise specified, all gears shall meet the accuracy requirements for AGMA quality No. Q11 in accordance with ANSI/AGMA 2000-A88. The gear quality is an indication of geometric accuracy of the gear. The higher the quality the higher the load capacity and the lower the noise level.			
4.1	Application- This quality procedure applies to ground gears.			
5.	Apparatus			
5.1	Gear teeth shall be inspected on a mechanical or computer numerically controlled (CNC) gear tooth inspection machine. Gear tooth inspections <u>shall not</u> be done on the gear tooth grinding machine.			
6.	Test Specimens			
6.1	Gears- Accuracy measurements shall be performed on gear teeth after all grinding is completed.			
7.	Procedure			
7.1	Temperature- Temperature in the immediate area of the inspection machine shall be 20°C ± 2°C.			
7.2	Verification- The accuracy and repeatability of the accuracy inspection machine shall be verified before any group of gears is inspected. At each verification, profile, tooth alignment, and pitch shall be checked on an artifact. Measured accuracy shall be within 2µm of the known dimension of the artifact.			
7.3	Calibration- The inspection machine shall be adjusted to maintain accuracy and repeatability within limits specified in 7.2 Verification and as specified by ANSI/AGMA 2010-A94 and ANSI/AGMA 2113-A97.			
7.4	Setup- Gears shall be setup in the gear inspection machine such that runout of datum (functional) surfaces is easily measured.			
7.4.1	Gears shall be inspected on the shafts they will operate on.			
7.4.2	Runout of datum (functional) surfaces shall be recorded.			
7.4.3	Teeth shall be identified as shown in Figure 2 or 4 and be numbered permanently.			
7.4.4	Reference face shall be identified as shown in Figure 1 or 2 and be numbered permanently.			

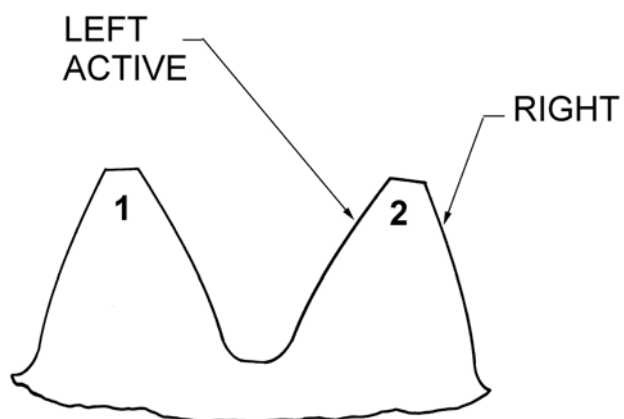
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7.4.5	Number of teeth inspected- Unless otherwise specified, profile and helix alignment shall be measured on the active flanks of four teeth equally spaced around the gear. Pitch shall be measured on all teeth.		
7.4.6	Measurement Position- Unless otherwise specified, measurements shall be made near midface for profiles, along the pitchline for helix alignment, and near midface and pitchline for pitch.		
7.5	Profile and tooth alignment chart annotations- All charts shall include the following:		
7.5.1	Inspectors stamp and date.		
7.5.2	Serial number of gear inspected.		
7.5.3	Sketch of gear orientation in the inspection machine showing direction of helix, top of gear, view direction, and reference face (for symmetrical gears) as shown in Figure 1 or 3.		
7.5.4	Sketch of end view of at least two teeth showing left/right flank designation, active flank designation, and tooth numbering convention as shown in Figure 2 or 4. End view shall be consistent with view direction specified in 7.5.3.		
7.5.5	Table showing number of teeth (z), normal module ( $m_n$ ), normal pressure angle ( $\alpha$ ), helix angle ( $\beta$ ), face width (b), and hand of helix.		
7.6	Profile chart annotations- All profile charts shall include the following annotations:		
7.6.1	Tooth numbers of teeth inspected.		
7.6.2	Left /right flank designation, active flank, and tip or root.		
7.6.3	Magnification of chart in horizontal and vertical directions.		
7.6.4	Base tangent lengths, roll angles or diameters corresponding to the following:		
7.6.4.1	MIN CHAM, MAX CHAM,		
7.6.4.2	MOD, HPSTC, LPSTC, SAP and PCD.		
7.6.4.3	Evaluation length.		
7.7	Tooth Alignment Chart Annotations- All tooth alignment charts shall include the following annotations:		
7.7.1	Tooth numbers of teeth inspected.		
7.7.2	Left/right flank designation, active flank, and top of gear consistent with Section 7.5.3.		
7.7.3	Magnification of chart in horizontal and vertical directions.		
7.7.4	Start of helix modifications.		
7.7.5	Evaluation length.		
8.	Interpretation of Results		
8.1	Accuracy- Accuracy of profile, tooth alignment, pitch, and runout shall be determined in accordance with ANSI/AGMA 2000-A88 or ANSI/AGMA ISO 1328-1 as specified on the engineering drawing for the gear.		

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8.2	Profile and helix modifications- Accuracy of profile and helix modifications shall be determined in accordance with the engineering drawing for the gear.			
9.	Acceptance Criteria			
9.1	Accuracy- The accuracy class shall be determined from the maximum variation of profile, tooth alignment, or pitch for any one tooth, or runout for all teeth. The accuracy shall be within the AGMA or ISO accuracy class specified on the engineering drawing for the gear.			
9.2	Profile and helix modifications- Location and magnitude of modifications shall be within the tolerances specified on the engineering drawing for the gear.			
10.	Report			
10.1	The report shall include the following:			
10.1.1	Description of the accuracy inspection machine.			
10.1.2	Profile charts.			
10.1.3	Tooth alignment charts.			
10.1.4	Pitch charts.			
10.1.5	Accuracy class.			
10.1.6	Records of calibrations.			

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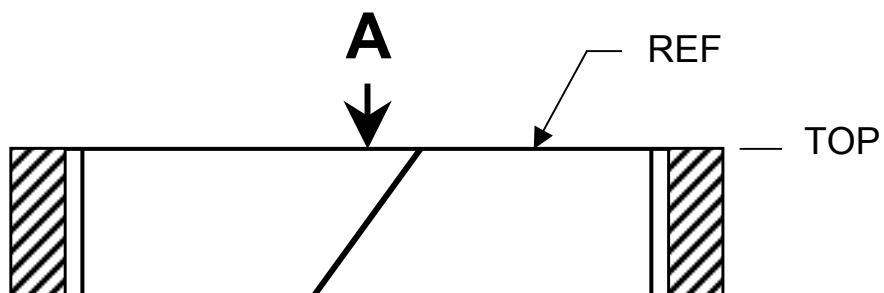
**FIGURE 1**



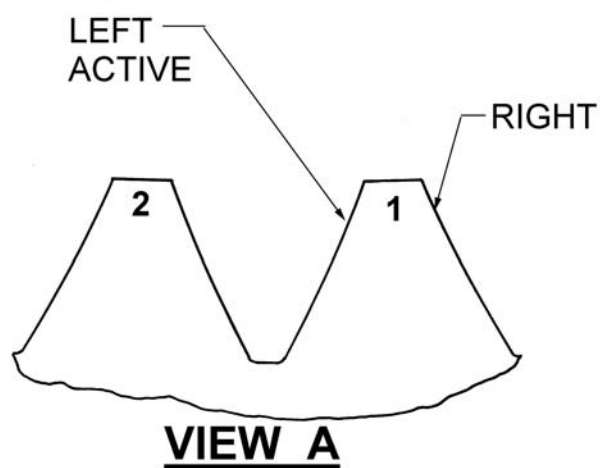
**VIEW A**

**FIGURE 2**

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**FIGURE 3**



**FIGURE 4**